



## FOSSIL ENERGY RESEARCH BENEFITS

### Natural Gas from Shale

**Shale gas** is natural gas trapped inside formations of shale — fine grained sedimentary rocks that can be rich sources of petroleum and natural gas. Just a few years ago, much of this resource was considered uneconomical to produce. But **Office of Fossil Energy (FE) research** helped refine cost-effective **horizontal drilling** and **hydraulic fracturing** technologies, protective environmental practices and data development, making hundreds of trillions of cubic feet of gas technically recoverable where they once were not.

Consequently, shale resources are contributing to a **rejuvenation of domestic natural gas supply** in the United States. The U.S. Energy Information Administration (EIA) reports that U.S. shale gas production has increased fourteen-fold over the last decade and reserves have tripled. Shale gas (**14 percent** of the total), coal bed methane and other unconventional resources combined now account for **46 percent of U.S. production**. This increased domestic supply has helped reduce the need for imports while enhancing U.S. energy security.

*FE's Eastern Gas Shale Research Program "is one of the great examples of value-added work led by the DOE."*

Dr. Terry Engelder  
Professor of Geosciences  
Penn State University, 2011

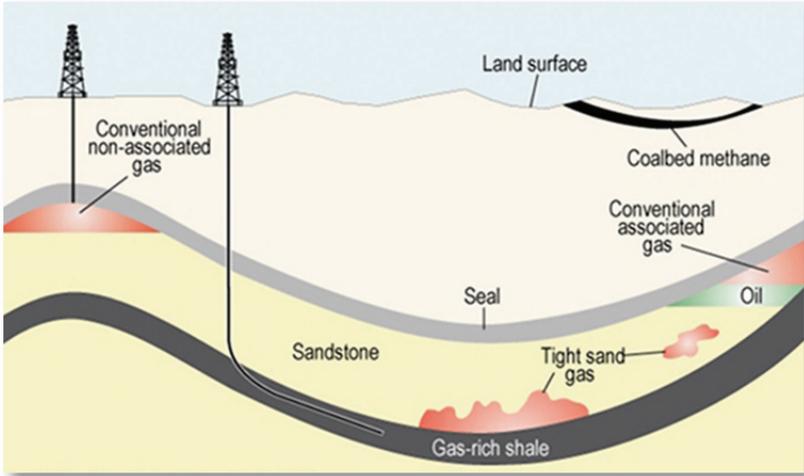


*Natural gas is sometimes trapped inside of organic rich black shale (source: <http://geology.com/energy/shale-gas/>). Photo courtesy of ALL Consulting.*

FE's early investments in shale research in the 1970s matched technology to complex geology for various settings. In 1986, FE collaborated with industry on the first air-drilled, 2,000-foot-long horizontal shale well in the Appalachian Basin.

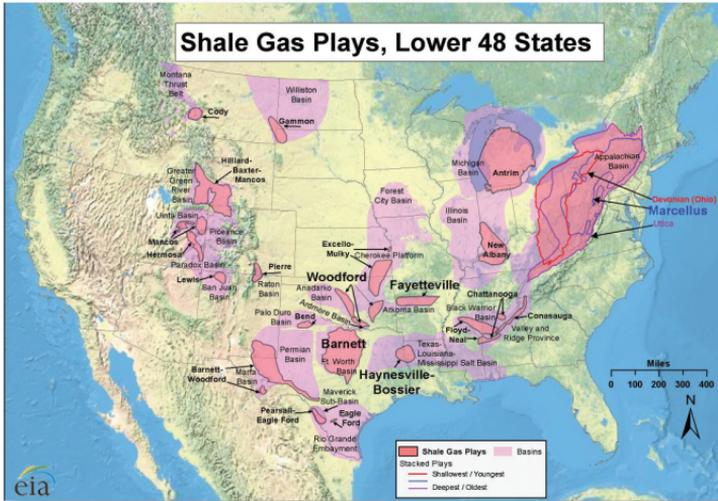
Through its **National Energy Technology Laboratory (NETL)**, FE pioneered **directional wells** (drilling at an angle other than vertical), **hydraulic fracturing** (using pressurized liquids to fracture subsurface rock) and other technologies.

## Natural Gas Schematic



Source: U.S. Energy Information Administration and U.S. Geological Survey

Building on past R&D successes, new technologies are being applied to make certain that the process of drilling for this valuable resource minimizes environmental impacts.



Source: Energy Information Administration based on data from various published studies. Updated March 10, 2010

According to EIA, the technically recoverable unproved shale gas resource is **827 trillion cubic feet**, about one-third of total U.S. resources, and continues to grow with more drilling activity. By 2035, shale is projected to meet **45 percent** of U.S. gas needs.



U.S. Department of Energy  
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